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[研究文章 Research Article]

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Biological Notes and the Male Description of *Metopius soror* Chiu, 1962 (Hymenoptera: Ichneumonidae: Metopiinae) in Taiwan

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Abstract.

Metopius soror Chiu, 1962 was originally described based on a single female. This study reports the host record of *M. soror* on *Nyctemera albofasciata* (Wileman, 1911) for the first time and female oviposition behavior on the larva of *N. adversata* (Schaller, 1788). We also provide the first description of the male of *M. soror*.

Keywords: Parasitoids, New host record, Oviposition behavior.

Introduction

Metopius Panzer, 1806 is a medium-sized and cosmopolitan genus comprising over 130 species worldwide, with seven species recorded in Taiwan (Chiu, 1962; Kusigemati, 1983; Yu et al., 2016). This genus is characterized by its uniformly concave face surrounded by a strong, shield-shaped carina, thick legs, and a cylindrical metasoma. As endoparasitoids of larval lepidopterans, they have a wide range of hosts, including Geometridae, Lasiocampidae, Noctuidae, Notodontidae, Sphingidae etc. (Tolkanitz, 2015).

Metopius soror Chiu, 1962 was originally described based on a single female specimen, without any additional information. In this study, we report the first host record and oviposition behavior of *M. soror*, and provide the first description of male *M. soror*. The morphological variation of *M. soror* is also discussed based on field observations and a male specimen.

Materials and methods

The third author made a field observation on July 16, 2021, at the Mt. Kantou trail [崁頭山步道] in Dongshan District, Tainan City, Taiwan, using a NIKON D810 camera with a NIKON AF Micro 60mm f/2.8 lens. The identification of field observation was based on comparing live photos (Figs 8–12) with the key and descriptions of Chiu (1962).

In this study, we adopted the morphological terminology and measurement protocols proposed by Broad et al. (2018). The holotype specimen of *M. soror* was examined at the Taiwan Agriculture Research Institute (TARI), Taichung City, Taiwan. The voucher specimen used in this study will also be deposited at TARI. Non-type specimens were examined and measured using a LEICA S8AP0 microscope with a micrometer. Stacked photos were taken with a LEICA DMC5400 camera connected to a LEICA Z16 APO with the auto-stacking system LAS V4.13 (Leica Microsystems, Germany). Figure editing was performed using Adobe Photoshop CC and Adobe Illustrator CC (Adobe Systems Inc., San Jose, CA, USA).

Results

Taxonomy

***Metopius* (*Tylopius*) *soror* Chiu, 1962**

姊妹盾臉姬蜂

(Figs 1–12)

Material examined. Holotype. 1♀; Taiwan, Musha [霧社]; 25. VI – 5. VII. 1947; leg. Maa, Chen, and Lin (TARI). **Non-type material.** 1♂; Taiwan, Nantou Cty., Xinyi Twp., Kalibuan Vil., Watchtower forest trail [瞭望台林道/望高寮林道], 23.58825679033767 N, 120.8702248428035 E; 30. VIII. 2016; leg. Y.-M. Hsu; reared from *Nyctemera albofasciata* (Wileman, 1911) (Lepidoptera, Erebidae) [帶紋蝶燈蛾] (TARI).

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Diagnosis. This species can be distinguished from other Taiwanese *Metopius* by the following combination of characters: fore wing hyaline, without any dark marking (Fig. 1); metasomal tergite I entirely yellow, profile angularly curved basally in lateral view (Fig. 1); interantennal process flat and lacks median carina (Fig. 3); scutellum and postscutellum apically yellow (Figs 4–5); propodeum anterior transverse carina present, lateromedian carina extend to about apical 0.7 of propodeum, not connect apically, and with short longitudinal carina apically (Fig. 5); metasomal tergite IV at least 1/2 yellow (Fig. 6).

This species is most similar in appearance to *M. (Metopius) rufus browni* Ashmead, 1905 among Taiwanese congeners, but can be distinguished from it by the following characters: fore wing hyaline (antero-apical area of fore wing with a dark spot in *M. rufus browni*), interantennal process flat, lacks median carina (median carina present in *M. rufus browni*), metasomal tergite I entirely yellow (basal 0.3 black in *M. rufus browni*), and pattern of propodeal lateromedian carina extend to about apical 0.7 of propodeum (extend to apex of propodeum in *M. rufus browni*).

Description of male. Male is similar to female (female description see Chiu (1962: 8)) in body structures, but differs as follows:

Measurements. Head about 0.5 as deep as wide; facial shield about 1.3 as long as wide; ocular-ocellus length (OOL) about 2.0 times diameter of lateral ocellus (OD); first flagellomere about 1.3 times as long as second; fore wing vein 3rs-m (= second intercubitus *sensu* Chiu (1962)) about 1.6 times as long as 2rs-m (= first intercubitus *sensu* Chiu (1962)) (Fig. 7); tergite I about 0.75 as long as wide; tergite II about 0.73 as long as wide; tergite III about 0.8 as long as wide; tergite IV about 0.76 as long as wide; hind femur about 2.6 as long as deep.

Coloration. face yellow without black spot; tergite II almost entirely black, with small yellow spots on lateral posterior corners; tergite III black, with apical 0.3 yellow; tergite IV black, with apical 0.5 yellow; tergites V and VI black, with apical margin yellow; metasomal tergites without brown color; tegula yellow; fore and mid legs yellow, except dorso-medial parts of femurs and dorsal side of fore coxa light brown; trochanters yellow; hind coxa blackish brown, with dorso-apical 0.4 and ventro-apical 0.6 yellow; hind femur yellow with one brownish spot in outer side, blackish brown except basal 0.1 and apical 0.3 yellow in dorsal and inner side; hind tibia and tarsus brown; parameres yellow, tapered and pointed apically in lateral view (Fig. 1).

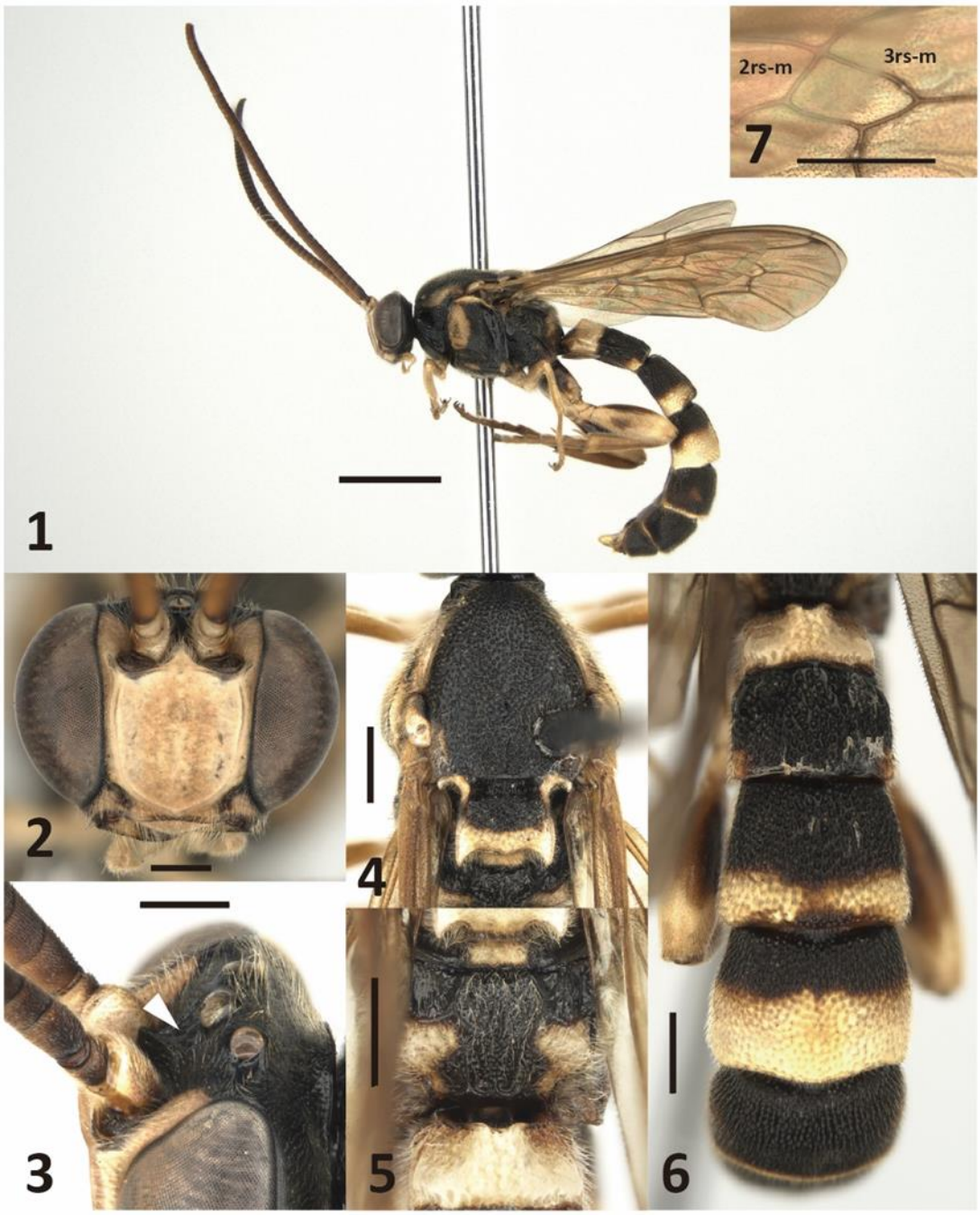
Distribution and bionomics. Taiwan (Nantou, Tainan). *Nyctemera albofasciata* is first reported as the host of *M. soror*.

Remarks. The description of the fore wing vein 3rs-m / 2rs-m ratio in couplet 3 of Chiu's *Metopius* key (Chiu, 1962: 6) was wrongly inverted as 2rs-m / 3rs-m. The revised couplet is shown below:

3. Fore wing second intercubitus about 2.0 times as long as first intercubitus; scutellum and postscutellum entirely black; first abdominal tergite partially black ……...……. ***M.* (*T.*) *fuscolatus***
   Fore wing second intercubitus about 1.5-1.6 times as long as first intercubitus (Figs 7, 12); scutellum and postscutellum yellow apically (Fig. 4); first abdominal tergite entirely yellow (Fig. 1) …… ***M.* (*T.*) *soror***

Field observation

The female *M. soror* was observed ovipositing on the larva of *N. adversata* (Schaller, 1788) (Lepidoptera, Erebidae) [粉蝶燈蛾] roosting on burnweed *Erechtites valerianifolius* (Link ex Spreng.) DC (Asterales, Asteraceae) [飛機草] (Figs 8–10). It was found moving around the host and tried to attack several times by bending its metasoma forward, the host was trying to escape but failed (Figs 8–10).

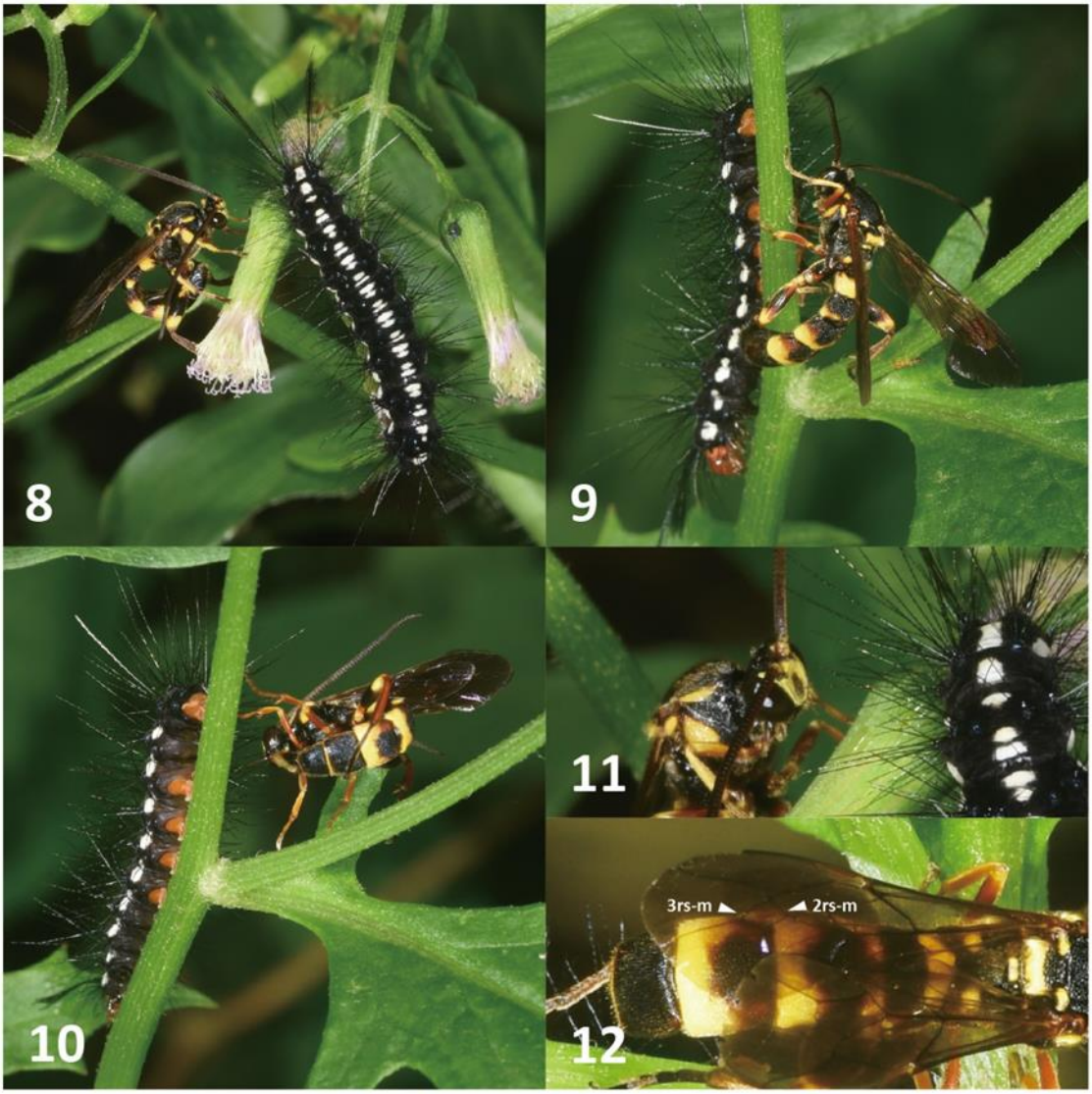


Figs 1–7. Male of *Metopius soror*. 1, habitus in lateral view; 2, head in frontal view; 3, interantennal process, indicated by white triangle; 4, mesoscutum, scutellum and postscutellum in dorsal view; 5, propodeum in dorsal view; 6, metasomal tergites in dorsal view; 7, areolet. Scale bars: 1, 3 mm; 2–3, 0.5 mm; 4–7, 1 mm.

Discussion

This study first discovered the intraspecific variation of *M. soror* whose sexual dimorphism exists in the body shape and coloration of metasomal tergites and legs. The male has a lower depth/width ratio of head, length/width ratio of tergite II, and larger OOL/OD ratio, the coloration is lighter on its legs, and no brown patterns on its metasomal tergites. In the female, variations also exist between the type specimen and the female shown in the photos, whose color pattern of the hind femur is more distinct.

The oviposition behavior observed suggests that *N. adversata* is the potential host of *M. soror*. The male described was also reared up from the larva of the congener *N. albofasciata*. These records suggest that *M. soror* may use mainly *Nyctemera* species as hosts.



Figs 8–12. *M. soror* ovipositing on the larvae of *N. adversata*. 8–10, live female of *M. soror* was moving around the larvae of *N. adversata* and tried to attack by bending its metasoma forward; 11, ditto, the face; 12, ditto, the fore wing (Photographed by Tsai-Wen Hsu).

Acknowledgments

We would like to express our sincere thanks to Chi-Feng Lee (TARI) for allowing the first author to examine specimens under his charge, Shiuh-Feng Shiao (Departmant of Entomology, National Taiwan University) and two reviewers for providing helpful suggestions on our manuscript, and Shipher Wu (National Taiwan Museum, Taipei, Taiwan) for confirming the identification of the lepidopteran larvae.

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姊妹盾臉姬蜂（膜翅目：姬蜂科：盾臉姬蜂亞科）之生物學短記暨雄蟲描述

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摘要：

姊妹盾臉姬蜂 (*Metopius soror* Chiu, 1962)是僅以一正模式標本所描述的物種，除模式標本再無其他採集與目擊紀錄。本研究首次報導姊妹盾臉姬蜂於帶紋蝶燈蛾 (*Nyctemera albofasciata* (Wileman, 1911)) 之寄主紀錄、其在粉蝶燈蛾 (*N. adversata* (Schaller, 1788)) 幼蟲之產卵行為及雄蟲描述。

關鍵字： 擬寄生昆蟲、新寄主紀錄、產卵行為。

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Additional Records of the Species of the Genus *Atholus* Thomson (Coleoptera, Histeridae) from Taiwan, with an Updated Key to the Taiwanese Species

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Abstract. Additional records of the genus *Atholus* from Taiwan are provided based on the museum and private collections in Taiwan and Japan. Eight species of the genus *Atholus* are recorded and distributed in Taiwan, with specimens of six species examined in this study. The key to Taiwanese species of *Atholus* is provided, and the illustrations of male 9th, 10th tergites, and 9th sternum of *Atholus levis* Mazur and *A. confinis* (Erichson) are published for the first time.

Keywords: fauna, distribution, description, taxonomy, Histerini

Introduction

The first comprehensive review of the genus *Atholus* Thomson from Taiwan was published by Ôhara (1999). Later, Mazur (2008) recorded *A. bifrons* (Marseul) from Taiwan based on a specimen collected in Taishan, New Taipei City. In the following year, Mazur (2009) reported another species, *A. confinis* (Erichson), and provided a key to Taiwanese *Atholus*. Finally, Mazur (2013) described a new species, *A. levis* from Laos, and included Taiwanese specimens in the type series. To date, eight species of *Atholus* are distributed in Taiwan, making it one of the most diverse genera of Histerini in the country.

This group is a cosmopolitan genus of Histerini distributed across the world, with an exception in the Continental Australia and Antarctica. Currently, there are 77 species of *Atholus*, with almost half of them occurring in the Oriental Region (Mazur, 2011). The group is characterized by its outwardly curved anterior margin of the mesoventrite, except for *A. coelestis*. However, the marginal stria of the mesoventrite is not emarginate in all *Atholus* species. Generally, the Oriental species have one pronotal lateral stria, and the subhumeral striae of the elytra may vary with either external, internal, both, or none, but usually not complete when present. Moreover, the carinal striae on prosternal keel are absent, and the protibia is generally dilated and stout, with the anterolateral angle bearing two or three denticles. The median lobe of the male genitalia without distinct armature, and the ducts of spermathecae are always not coiled.

In this study, we examined more than one hundred specimens from museum and private collections in Taiwan and Japan. As a result, six species were identified through close examination of the specimens. We illustrated the male 9th and 10th tergites, as well as the 9th sternum of *Atholus levis* Mazur and *A. confinis* (Erichson) for the first time. In addition, we provided distributional records that shed light on Taiwanese biogeography. Furthermore, we updated the key to species of the genus *Atholus* from Taiwan.

Materials and methods

To conduct morphological observations, specimens were collected and preserved under dry conditions. Genitalia were prepared following the methodology of Ôhara (1994). We took color photographs using a Canon EOS 650D camera with a Canon MP-E65 f2.8 1–5x Macro lens, and stacked all photos using Helicon Focus 5.3 Pro. The terminology used in this study follows Ôhara (1994). The specimens were deposited in the following locations: Systematic Entomology, Hokkaido University, Sapporo, Japan (SEHU); National Museum of Natural Science, Taichung, Taiwan (NMNS); Taiwan Agricultural Research Institute, Taichung, Taiwan (TARI); National Taiwan University, Taipei, Taiwan (NTU); private collection of Yu-Hsiang Ho, Taichung, Taiwan (PCHO); and private collection of the late Taichi Shibata, Osaka, Japan (PCSH).

Results

Family Histeridae Gyllenhal, 1808
Subfamily Histerinae Gyllenhal, 1808
Tribe Histerini Gyllenhal, 1808

Genus *Atholus* C.G. Thomson, 1859
弓腹閣魔蟲屬

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Atholus C.G. Thomson, 1859: 76. Type species: *Hister bimaculatus* Linnaeus, 1758.
Atholister Reitter, 1909: 286. Type species: *Hister scutellaris* Erichson, 1834.
Euatholus Kryzhanovskij, 1976 (in: Kryzhanovskij & Reichardt, 1976): 387. Type species: *Hister duodecimstriatus* Schrank, 1781.
Peranus Lewis, 1906: 401. Type species: *Hister scutellaris* Erichson, 1834.

Atholus bifrons (Marseul, 1854)
凹額弓腹閹魔蟲

Hister bifrons Marseul, 1854: 545 [India].
Atholus bifrons: Lewis, 1906: 402; Mazur, 2009: 113 [New to Taiwan]; dela Cruz & Ôhara, 2022: 237 [Japan].

Specimens examined. TAIWAN. [Taichung City] 1 ex., Tunghai University, 10.X.1993, R. J. Yao (NTU).

Distribution. Hong Kong; India; Indonesia; Japan; Taiwan (Fig. 7); Thailand; Vietnam (Mazur, 2011).

Atholus coelestis (Marseul, 1857)
蒼穹弓腹閹魔蟲

Hister (*Atholus*) *coelestis*: Miwa, 1931: 57 [Kôshun]; Kamiya & Takagi, 1938: 31.
Atholus coelestis: Lewis, 1915: 55; Ôhara, 1992: 173; 1994: 137; 1999: 31 [Taipei City, Nantou County, Chiayi County, Tainan City, Kaohsiung City, Pingtung County, Lanyu Is., Lutao Is.]; Mazur et al., 2015: 1454 [Luzon].

Specimens examined. TAIWAN: [Taipei City] 1 ex., Qingtiangang, 2.X.1992, C. Y. Lai (NTU); 1 ex., Taipei, 28.IV.1970, K. S. Lin (TARI); 1 ex., Hsintien, Taipei, 9.V.1967, K. S. Lin (TARI). [Taoyuan City] 1 ex., Shihmen Reservoir, 27.VII.1969, T. Kobayashi (PCSH). [Hsinchu County] 4 exs., Neiwan, 24.VII.1969, Y. Maeda (PCSH). [Nantou County] 2 exs., Guandaoxi, 29.IV.1980, A. Tanaka (SEHU); 5 exs., same locality but different date, 15.V.1989 (SEHU); 1 ex., Feng Kuei Dou, 15.X.2006, T. C. Wang (SEHU). [Pingtung County] 1 ex., Fangliao, Yuquan V., 22.4333, 120.6051, 11.III.2018, cow dung, B. H. Ho (PCHO); 1 ex. Manzhou, 28-30.VI.2019, cow dung, Y. H. Ho (PCHO); 3 exs., Baoli, 11.II.2019, cow dung, K. W. Chan (PCHO); 2 exs., Hengchung, 13.XI.1980, T. C. Hsu (NTU); 1 ex., Sizhongchi, 11.V.1986, M. Ôhara (SEHU); 1 ex., Kengting, 7.XI.1987, C. F. Lee (NTU). [Hualien County] 8 exs., Shoufeng, 12.I.2019, cow dung, Y. H. Ho (PCHO). [Taitung County] 3 exs., Lanyu Island, 8.X.1970, Y. Kiyoyama (PCSH); 1 ex., same locality but different date and collector, 25.III.1971, H. Nomura (PCSH); 1 ex., same locality but different date and collector, 14.VII.1972, Y. Maeda (PCSH); 5 exs., Lu-tao Is. (Lüdao Is.), 26 to 28.IV.1986, M. Ôhara (SEHU). [Kinmen County] 2 exs., Jinsha, 4.IV.2019, Y. H. Ho (PCHO); 1 ex., Jinsha, Tianpu Reservoir, 31.III.2019, Y. H. Ho & P. Y. Shih (PCHO); 1 ex., Houhu, 1.VI.2019, Y. H. Ho (PCHO); 2 exs., Lieyu, 2.IV.2019, cow dung, Y. H. Ho & P. Y. Shih (PCHO).

Distribution. Celebes; China; Comores; India; Indochina; Japan; Nepal; Philippines; Sri Lanka; Taiwan (Fig. 7); Tajikistan (Mazur, 2011).

Atholus confinis (Erichson, 1834)
長紋弓腹閹魔蟲
(Figs 1−3)

Hister confinis Erichson, 1834: 154 [Cuba].
Atholus confines: Mazur, 2009: 114 [synonymic note].
Atholus rothkirchi Bickhardt, 1919: 143, synonymized by Mazur, 2009: 114.

Specimens examined. TAIWAN: [Chiayi County] 1 ♀, Zhongpu, 27.VII.2021, J. C. Lin (PCHO). [Pingtung County] 1 ♂. Fangliao, Yuquan V., 22.4333, 120.6051, 11.III.2018, Cow dung, B. H. Ho (PCHO); 1 ♂, Same locality and date but different collector, Y. H. Ho & P. Y. Shih (PCHO).

Distribution. Africa (tropical); Cuba; Dominicana; Guadeloupe; Puerto Rico; St. Vincent; Taiwan (introduced?) (Fig. 7); USA: Florida, Hawaii; Yemen (Mazur, 2011)

Note. The specimens in our study were collected from cow dung or localities close to stock farms. Lundyshev (2017) recorded this species as being collected from cow excrement in Tanzania, while Gomy (2004) reported finding this species in cow dung in the Republic of Yemen. These data suggest that cow excrement may be the primary habitat for this species. However, Tishechkin (2010) recorded two specimens collected by pitfall trap near bat guano and one specimen collected from a rabbit carcass in Florida.

Atholus depistor (Marseul, 1873)
毛弓腹閹魔蟲

Peranus depistor: Lewis, 1915: 55 [Horisha].
Hister (*Peranus*) *depistor*: Miwa, 1931: 57 [Horisha]; Kamiya & Takagaki, 1938: 31.
Atholus depistor: Ôhara, 1992: 176 [Taiwan: Kenting Park]; 1999: 32 [Nantou County, Hualien County, Pingtung County].

Specimens examined. TAIWAN: [Taipei City] 1 ex., Taipei, 1967, K. S. Lin (TARI); 1 ex., Yanmingshan, 28.X.2007, J. F. Tsai & T. C. Wang (TARI). [Hsinchu County] 1 ex., Neiwan, 23.VII.1969, Y. Maeda (PCSH). [Pingtung County] 1 ex., Tai-wu, Pei-ta-wu-shan, 900 m, 1.VIII.2015, Y. T. Chung (TARI); 1 ex., Fangliao, Yuquan V., 22.433205, 120.605166, 11.III.2018, cow dung, Y. H. Ho (PCHO); 1 ex., same locality but different date and collector, 26.XI.2017, B. H. Ho (PCHO). [Kinmen County] 1 ♀, Jinning, 24.4594, 118.3020, 18.VIII.2020, K. T. Lin (PCHO).

Distribution. Eastern China; Japan; Korea; Russia: Far East; Taiwan (Fig. 7) (Mazur, 2011).

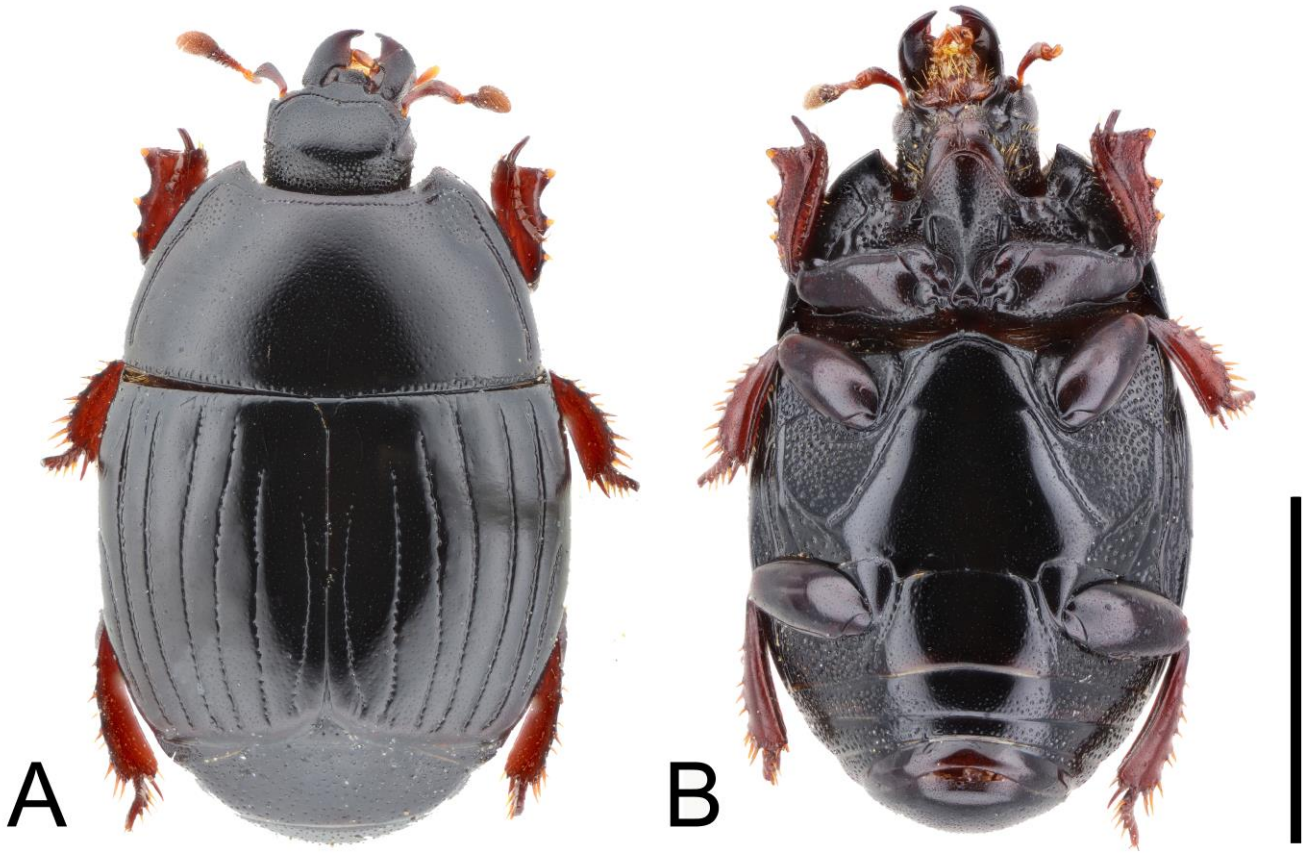

Fig. 1. *Atholus confinis* (Erichson, 1834), habitus. A. Dorsal view. B. Ventral view. Scale bar = 2.0 mm.

***Atholus duodecimstriatus quatuordecimstriatus* (Gyllenhal, 1808)**
十四紋弓腹閣魔蟲

Hister (*Atholus*) *duodecimstriatus*: Miwa, 1931: 57 [Taipei]; Kamiya & Takagi, 1938: 31.
Atholus duodecimstriatus quatuordecimstriatus: Lewis, 1915: 55 [Taipin]; Ôhara, 1993: 135; 1994: 137; 1999: 32 [Taiwan: Nantou County].

Specimens examined. No available additional specimens for this study.

Distribution. Continental China; Japan; Korea; Nepal; Northern and high elevations in Central Europe; Oman; Russia: Primorskij and Ussuriyskij Kray; Sweden; Taiwan; Vietnam (Mazur, 2011).

Note. After re-examining a female specimen from Nantou County that was previously recorded by Ôhara (1999), we have determined that it was misidentified and actually belongs to *A. pirithous* (Marseul, 1873). Ôhara (1999) had noted that the specimen had the 5th dorsal stria present on the apical half and sutural stria present on the apical two-thirds, but upon closer examination, we were able to confirm the correct identification as *A. pirithous*.

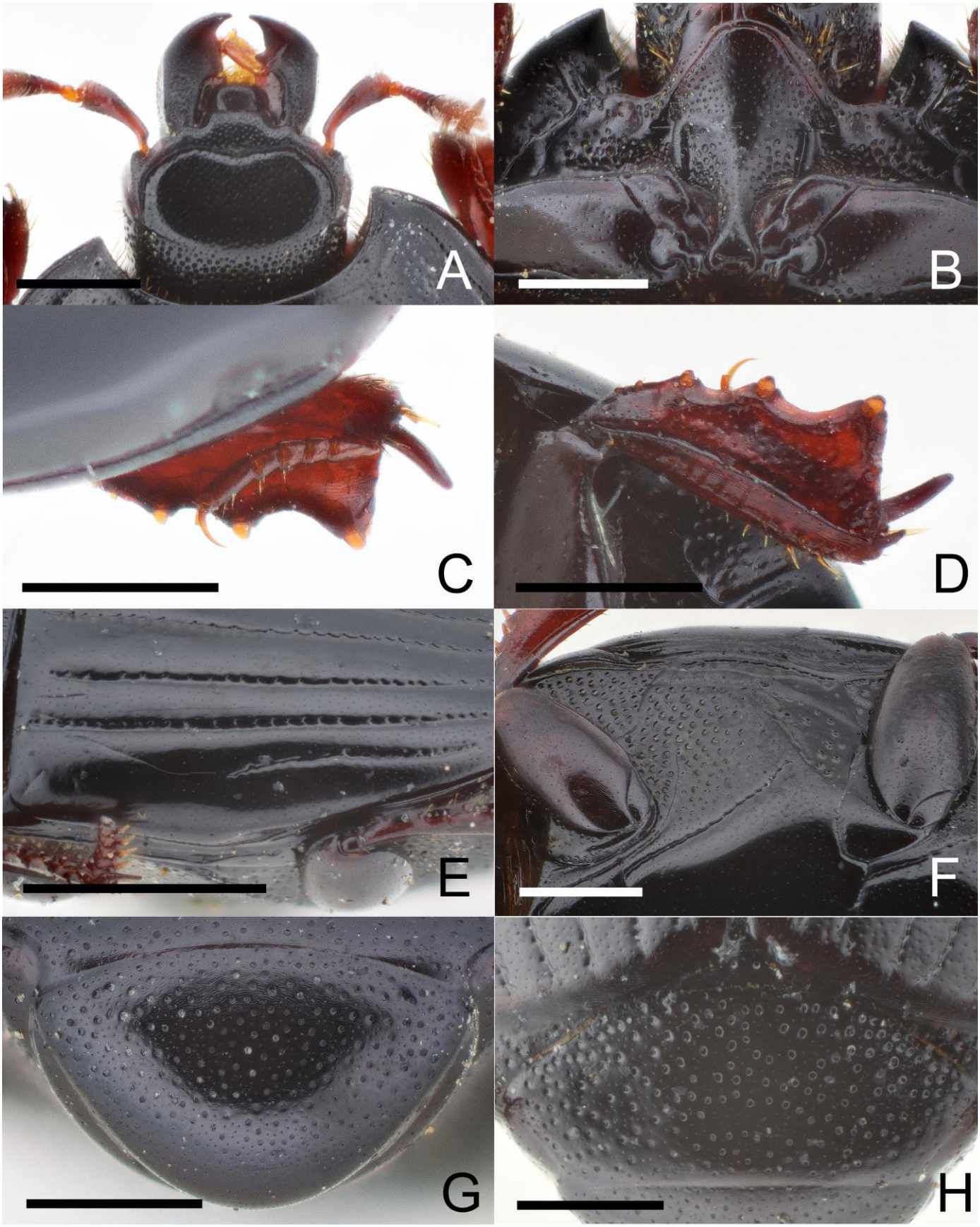

Fig. 2. *Atholus confinis* (Erichson, 1834), habitus. A. Head, dorsal view. B. Prosternum, ventral view. C. Right protibia, dorsal view. D. Ditto, ventral view. E. Subhumerus of left elytron, lateral view. F. Mesoventrite, ventral view. G. Pygidium, caudal view. H. Propygidium, caudal view. Scale bars: A−D, F−H = 0.5 mm, E = 1.0 mm.

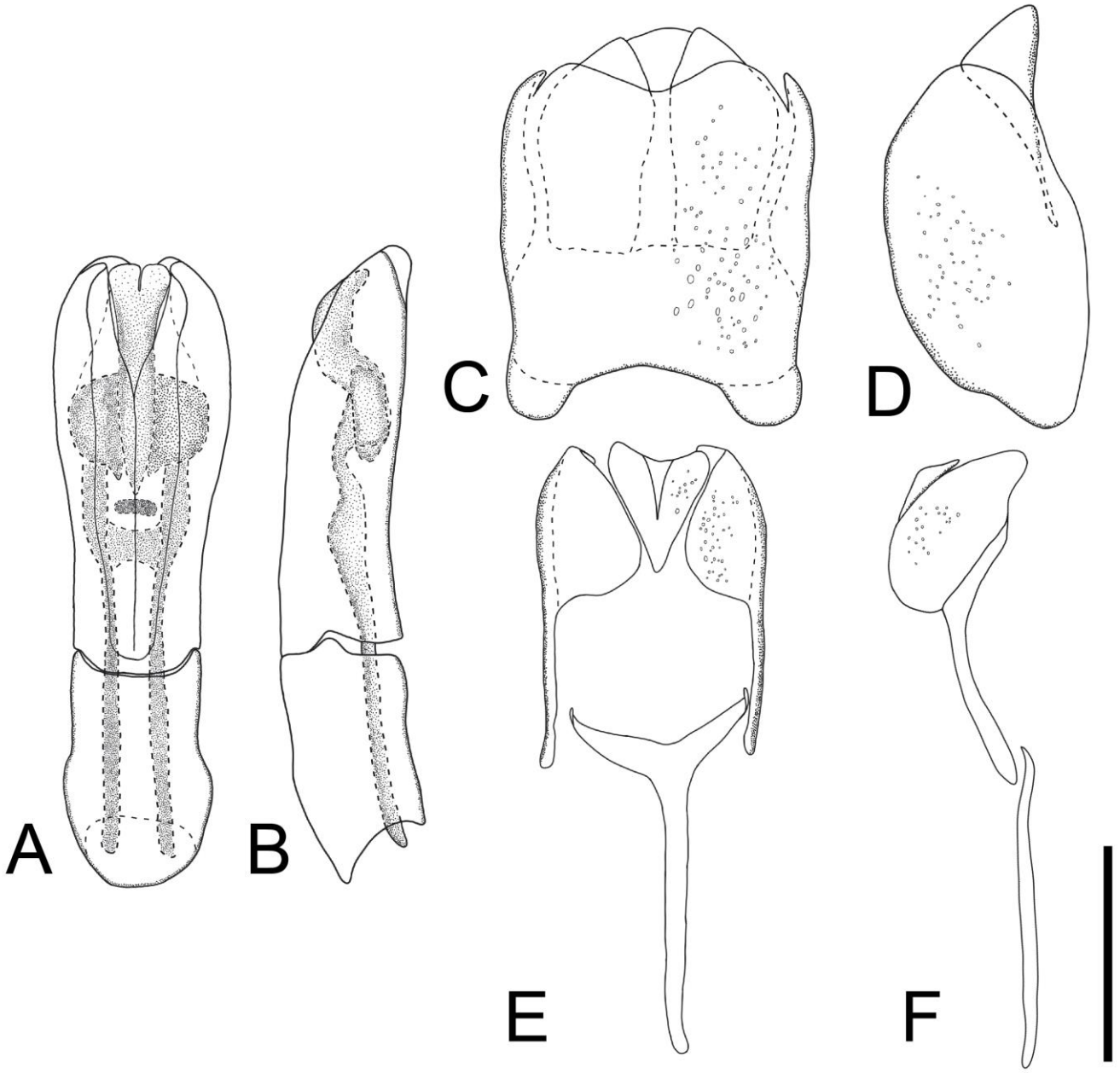

Fig. 3. *Atholus confinis* (Erichson, 1834), male genitalia. A. Aedeagus, dorsal view. B. Ditto, lateral view. C. 8th tergite and sternite, dorsal view. D. Ditto, lateral view. E. 9th and 10th tergites and 9th sternum, dorsal view. F. Ditto, lateral view. Scale bar = 0.5 mm.

***Atholus levis* Mazur, 2015**
勒氏弓腹閣魔蟲
(Figs 4–6)

Atholus levis Mazur, 2013: 195 (without type deposition locality) [Nantou County: Jhushan]; Mazur, 2015: 2 (with type deposition locality).

Specimens examined. TAIWAN: [Nantou County] 3 exs., Ren'ai, Huisun Forest Area, 6.V–9.VI.2018, flight interception trap, Y. H. Ho (PCHO); 1 ex., same locality and method but different date and collector, 29.IV–16.V.2018, W. R. Liang (PCHO); 1 ex., same locality, collector, and method but different date, 9−25.VI.2018 (PCHO); 1 ex., same locality, collector, and method but different date, 26.VII−14.VIII.2018 (PCHO); 1 ex., same locality, collector, and method but different date, 9.VI−6.X.2019 (PCHO); 1 ex., same locality and method but different date and collector, 19–22.IV.2020, Y. H. Ho & P. Y. Shih (PCHO). [Chiayi County] 2 exs., Dapu, Shimiantong, 25.V–8.VI.2011, flight interception trap, M. L. Jeng (NMNS). [Tainan City] 1 ex., Xinhua, Sinhua Forest Reserve, 5.II–4.III.2020, flight interception trap, G. Y. Chen (PCHO). [Pingtung County] 1 ex., Manzhou, IV−8.V.2011, M. L. Jeng

(NMNS).

Distribution. Nepal; Oriental Region; Taiwan (Fig. 8) (Mazur, 2011).

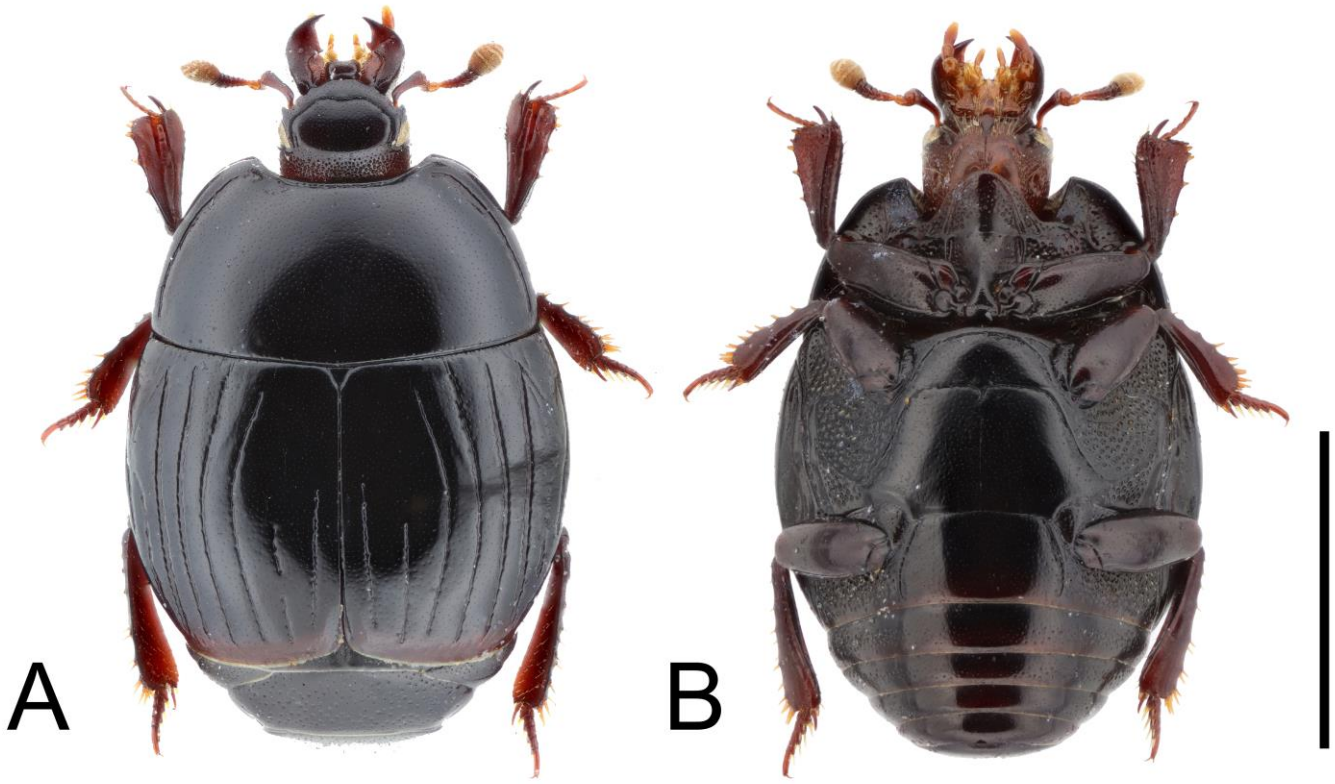

Fig. 4. *Atholus levis* Mazur, 2015, habitus. A. Dorsal view. B. Ventral view. Scale bar = 2.0 mm.

***Atholus philippinensis* (Marseul, 1854)**
菲律賓弓腹閹魔蟲

Hister philippinensis Marseul, 1854: 547.
Hister philippensis (sic): Gemminger & Harold, 1868: 771.
Hister (*Atholus*) *philippinensis*: Bickhardt, 1913: 173 [Taiwan: Hoozan and Taihorin]; Miwa, 1931: 57 [Hoozan, Taihorin]; Kamiya & Takagi, 1938: 31.
Hister sectator Lewis, 1901: 375, synonymized by Bickhardt, 1917: 194.
Atholus sectator: Lewis, 1906: 402.
Atholus philippinensis: Lewis, 1906: 402; 1915: 55; Ôhara, 1999: 36 [Nantou County].

Specimens examined. No available additional specimens for this study.

Distribution. Borneo; Burma; India; Java; Malaysia; Philippines; Southern China; Sumatra; Taiwan; Vietnam (Mazur, 2011).

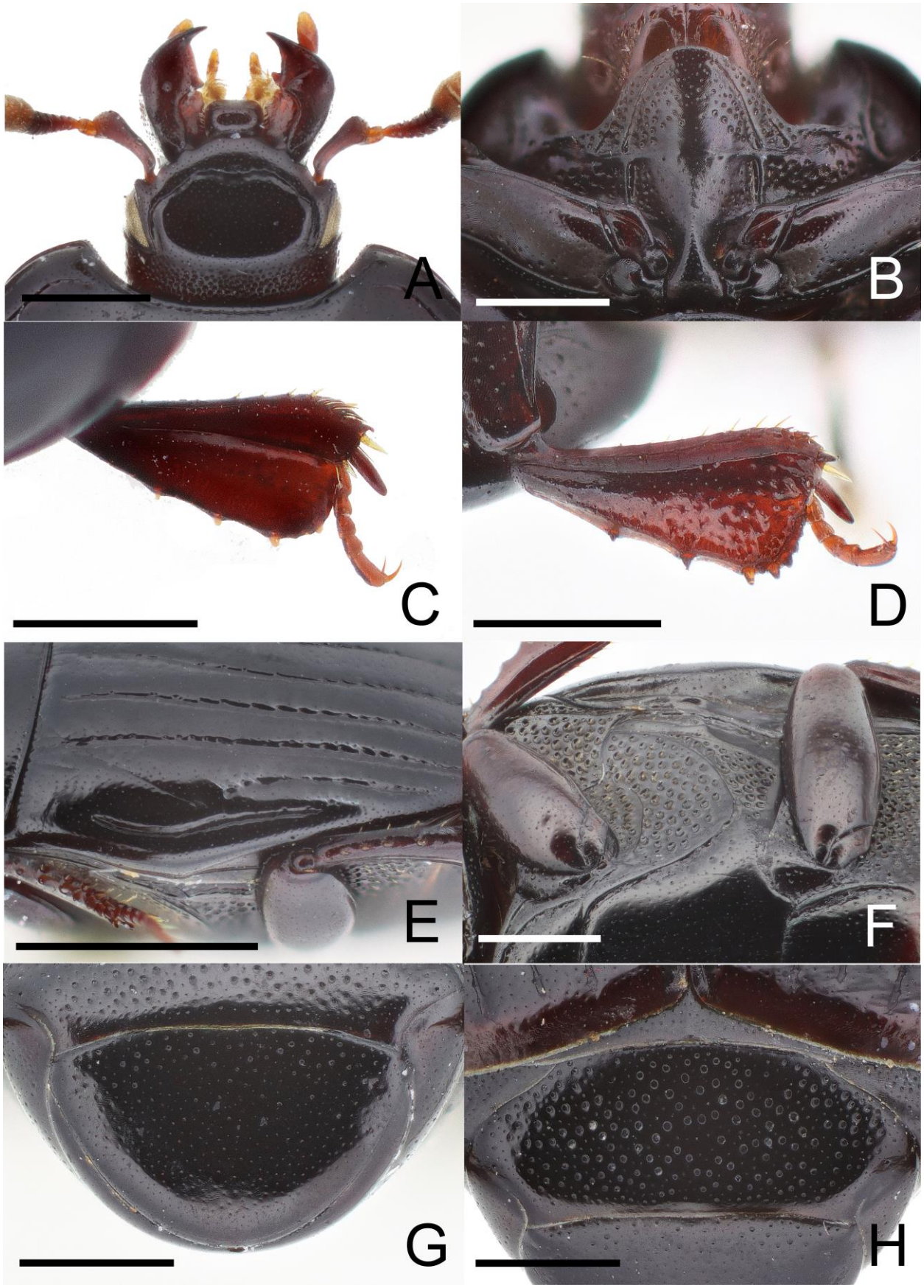

Fig. 5. *Atholus levis* Mazur, 2015, habitus. A. Head, dorsal view. B. Prosternum, ventral view. C. Right protibia, dorsal view. D. Left protibia, ventral view. E. Subhumerus of left elytron, lateral view. F. Mesoventrite, ventral view. G. Pygidium, caudal view. H. Propygidium, caudal view. Scale bars: A−D, F−H = 0.5 mm, E = 1.0 mm.

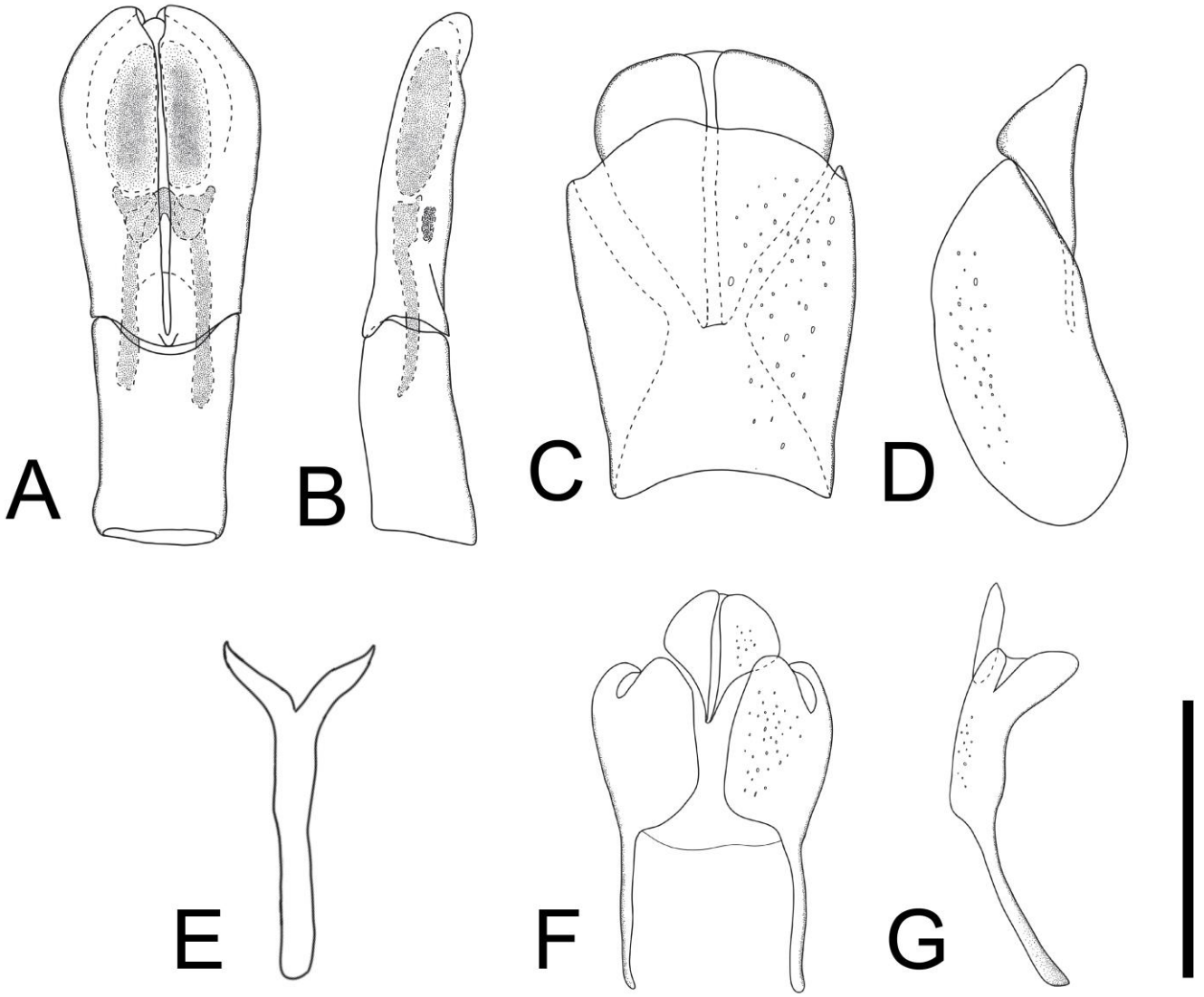

Fig. 6. *Atholus levis* Mazur, 2015, male genitalia. A. Aedeagus, dorsal view. B. Ditto, lateral view. C. 8th tergite and sternite, dorsal view. D. Ditto, lateral view. E. 9th sternum, dorsal view. F. 9th and 10th tergites, dorsal view. G. Ditto, lateral view. Scale bar = 0.5 mm.

Atholus pirithous (Marseul, 1873)
皮氏弓腹閻魔蟲

Hister pirithous Marseul, 1873: 224.
Hister ixion Lewis, 1892: 30, synonymized by Mazur, 2009: 115.
Hister reitteri Bickhardt, 1918: 231.
Hister (*Atholus*) *pirithous*: Bickhardt, 1913: 173 [Taiwan: Taihorin and Hoozan]; Miwa, 1931: 58 [Taihorin, Hoozan]; Kamiya & Takagi, 1938: 31.
Atholus pirithous: Lewis, 1915: 55 [Shinten]; Ôhara, 1993: 141; 1994: 138; 1999: 36 [Taipei City, Taoyuan City, Taichung City, Nantou County, Kaohsiung City, Pintung County, Hualien County, Lanyu Is.].

Specimens examined. TAIWAN: [Taipei City] 1 ex., Taipei, 13.V.1967, K. S. Lin (TARI); 1 ex., Da'an, Fuyang Eco Park, 9.II.2019, H. Y. Lin (PCHO). [Taoyuan City] 1 ex., Tungyanshan, 28.VI.2010, H. Lee (TARI); 1 ex., Fuxing, Taman, 6.VII.2007, T. Y. Liu (PCHO). [Hsinchu County] 1 ex., Beipu, 24.7052, 121.0594, 2.III.2019, in the rotten banana, H. C. Liu (PCHO). [Miaoli County] 1 ex., Guandaoshan, 28.VII.1995, no collector's name (SEHU). [Taichung City] 25 exs., Kukuan, 730 m, 14–17.X.1980, K. S. Lin & C. H. Wang (TARI). [Nantou County] 1 ex., Wusha, 1,150 m, 14.VII.1982, S. C. Lin & C. N. Lin (TARI); 2 exs., Lushan, 1,000 m, 27–31.V.1980, S. C. Lin & C. N. Lin (TARI); 1 ex., Huisun Forest Area, 23.IV.2015, Y. T. Chung (TARI); 1 ex., same locality but different date and collector, 7.VI–6.X.2019, flight interception trap, W. R. Liang (PCHO); 2 exs., Ren'ai, Qingjing Farm, 27.VII.2018, Y. H. Ho & P. Y. Shih (PCHO); 1 ex., Ren'ai, Meifeng, 15.VII.2021, Y. H. Ho & C. T. Hsu (PCHO); 1 ex., Mt. Guandao,

Heping, 8.VIII.1995, no collector's name (SEHU); 1 ex., Jenai, Nanshanhsi, 28.II.2001, C. C. Lo (NMNS); 1 ex., Lushan, 16.IX.1997, C. C. Lo (NMNS); 1 ex., Guguan, Heping Dist., 1,250 m, 8.VIII.1989, M. Ôhara, from decaying pinapple (SEHU); 3 exs., Shihsihto, Puli, 7, 8 & 10.VIII.1989, M. Ôhara (SEHU); 1 ex., Pilu, 21.VIII.1979, K. Sugino (SEHU). [Pingtung County] 6 exs., Kenting Forest Recreation Area, 21˚58'05.3"N 120˚49'00.7"E, #390, 12 to 16.VIII.2010, Flight Interception Trap, Coleptera 4 to 7, 9 & 10, Tseng Hsin-Huei & Lan Yen-Chiu (SEHU); 1 ex., Linlo, 27.XII.2012, J. C. Chen (TARI); 1 ex., Fangliao, Yuquan V., 22.4332, 120.6051, 11.III.2018, cow dung, Y. H. Ho (PCHO). [Taitung County] 1 ex., Xichuanshan, 470 m, 31.III.2019, Monkey Dung, B. H. Ho (PCHO); 3 exs., Lijia Rindao, Beinan Twonship, 30.VI.2014, T. Niisato (SEHU). [Hualien County] 1 ex. Shoufeng, 12.I.2019, cow dung, Y. H. Ho (PCHO). [Ilan County] 1 ex., Yulan, 3.V.2018, Y. H. Ho & F. S. Hu (PCHO).

Distribution. China: Guandong, Shanghai; Japan; Korea; Nepal; Oman; Russia: Far East; Taiwan (Fig. 8); Vietnam (Mazur, 2011).

Key to the Taiwanese Species of the Genus *Atholus* (modified from Ôhara, 1999; Mazur, 2009)

1. Lateral pronotal stria incomplete, present only on apical half; apical end of 3rd dorsal elytral stria strongly bent medially ……..……..……..... *A. coelestis* (Marseul, 1857)
- Lateral pronotal stria nearly complete; 3rd dorsal elytral stria not strongly bent 2
2. Fifth dorsal and sutural elytral striae present only on apical half ……..……...……..… 3
- Fifth dorsal and sutural striae complete or sutural stria slightly abbreviated basally ……...……...…. 6
3. Fourth elytral dorsal stria nearly complete, external subhumeral stria short and present medio-basally 4
- Fourth elytral dorsal stria abbreviated basally, external subhumeral stria long, shortly abbreviated on apical fourth …….. *A. philippinensis* (Marseul, 1854)
4. Inner lateral pronotal stria incomplete behind the head; protibia with denticles on apical angle sparsely present……..... *A. levis* Mazur, 2015
- Inner lateral pronotal stria complete behind the head; protibia with denticles on apical angle oppressed together ……..... 5
5. Frons longitudinally incised at middle; anterior margin of pronotum outwardly and acutely arcuate; pygidium coarsely punctured ….....…..... *A. bifrons* (Marseul, 1854)
- Frons flat; anterior margin of pronotum feebly emarginated; pygidium finely punctate ….....… *A. pirithous* (Marseul, 1873)
6. Lateral disc of metasternum with long hairs; external subhumeral stria present medially, usually united with internal one; propygidium evenly and coarsely punctuate ……..... *A. depistor* (Marseul, 1873)
- Lateral disc of metasternum without hair; external subhumeral stria wanting; propygidial punctation becoming coarser basally ……..... 7
7. Pronotal foveae present in anterolateral angles ……..... *A. confinis* (Erichson, 1834)
- Pronotum without foveae in anterolateral angles ..... *A. duodecimstriatus quatuordecimstriatus* (Gyllenhal, 1808)

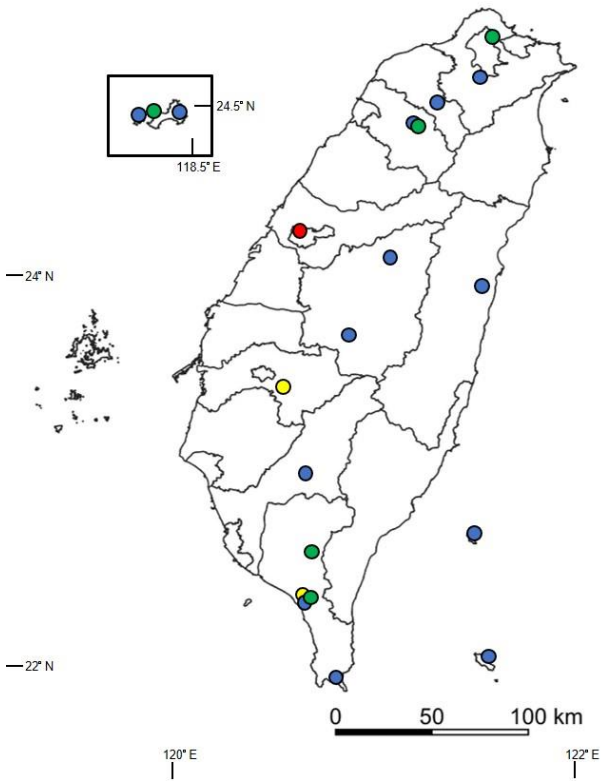

Fig. 7. Specimen records of *Atholus* spp. in Taiwan in this study. Green spots: *A. depistor* (Marseul, 1873). Red spots: *A. bifrons* (Marseul, 1854). Blue spots: *A. coelestis* (Marseul, 1857). Yellow spots: *A. confinis* (Erichson, 1834).

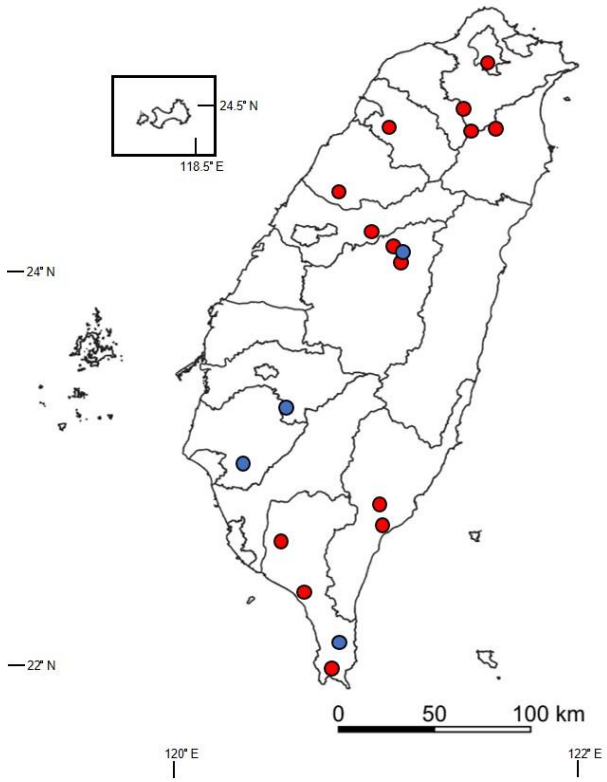

Fig. 8. Specimen records of *Atholus* spp. in Taiwan in this study. Red spots: *A. pirithous* (Marseul, 1873). Blue spots: *A. levis* Mazur, 2015.

Acknowledgments

We appreciate the late Prof. C. C. Ko (Department of Entomology, National Taiwan University, Taiwan), Dr. J. R. Liao (Tokyo Metropolitan University, Japan), Dr. C. F. Lee (Division of Applied Zoology, Taiwan Agricultural Research Institute), Dr. J. F. Tsai (Biology Department, National Museum of Natural Science, Taiwan), Dr. T. Niisato (Tokyo, Japan), Dr. K. Ando (Osaka, Japan), Dr. Y. Hayashi (Osaka, Japan), and Dr. K. Sugino (Hyogo, Japan) for granting us the privilege of studying specimens from their institutes' collections. We would also like to thank Dr. Mei-Ling Chan (Biology Department, National Museum of Natural Science, Taiwan) for providing the photography equipment. Lastly, we express our gratitude to Dr. S. Mazur (Warsaw, Poland) for helping us confirm the identity of certain specimens.

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臺灣產弓腹閻魔蟲屬之補充紀錄及物種檢索表 (鞘翅目：閻魔蟲科)

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摘要：本研究根據臺灣及日本的博物館館藏與私人蒐藏標本，提供臺灣產弓腹閻魔蟲屬(*Atholus*)的補充紀錄。臺灣的弓腹閻魔蟲屬目前已記錄八種，本研究檢視其中六種。同時也更新了臺灣產弓腹閻魔蟲屬之物種檢索表，並首次提供勒氏弓腹閻魔蟲(*Atholus levis* Mazur)及長紋弓腹閻魔蟲(*A. confinis* (Erichson)) 的雄性第九至十節背板及第九節腹板之圖像。

關鍵詞：動物相、分布、描述、分類學、閻魔蟲族

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